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"THE ANATOMY OF GLENARD'S DISEASE."

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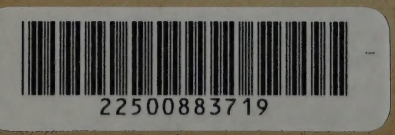

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"THE ANATOMY OF GLENARD'S DISEASE."

AN OPENING LECTURE
BY
ARTHUR KEITH, M.D., *Lecturer on Anatomy.*

Mr. Keith gave his Opening Lecture in the Anatomical Theatre, at mid-day on Monday, October the 6th. Many specially prepared diagrams and two newly designed models were shewn to demonstrate the respiratory movements of the abdominal viscera. The hour fixed for the Lecture made it impossible for many Students working in the Wards to be present, and as the subject is one of value, and perhaps of interest, to them, we report it at some length here.

GENTLEMEN,

Those of you who have worked in the Dissecting Room must have noticed that in one subject out of, perhaps, every ten or twelve the abdominal viscera do not occupy their normal position, but that all of them are displaced downwards, the liver and stomach usually suffering to a greater extent than the other organs. The condition occurs three or four times more frequently in women than in men. This is a condition which has received a very great deal of attention from clinicians during the last decade; often it is called "Glenard's disease," from the Parisian physician who has spread his verbose studies over a book of 600 closely printed pages. "Displacement of the abdominal viscera," "Enteroptosis," are two of the names given to the condition, but there are many more. Because of its brevity, and because it is clearly recognised by Glenard that ptosis and misshapement of the liver, displacement and elongation of the stomach, displaced and floating kidney and spleen, sinking of the intestines, certain forms of herniæ and prolapse of the pelvic viscera, are all part and parcel of one general condition, it is convenient to recognise this general condition by his name. The manner in which the abdominal viscera are fixed and retained in position is one which lies strictly within the province of the anatomist, and I hope, before the hour is up, to shew you not only how they are fixed, but how they become displaced, and give rise to an infinite variety of vague and distressing symptoms.

During the autumn, when I intended to pursue an investigation I commenced some years ago into the manner in which the viscera were fixed in other animals besides man, I expected my work to lie mostly within the abdominal cavity itself, and to be directed towards the peritoneal and other ligaments of the viscera. But as the liver and stomach were fixed almost entirely to the diaphragm, I saw that the first matter that required to be settled was "How is the diaphragm kept in position, and what movements do the stomach and liver undergo when the diaphragm contracts, for all three must move together?"

Variability in the Position of the Diaphragm. The first point investigated was the common position of the diaphragm after death. I took 50 cases, 35 males and 15 females; 40 of these cases were obtained from very valuable records made by Dr. Addison, Lecturer on Anatomy at Charing Cross Medical School. The position varied enormously, as the Table (Table I.) I give here, which deals with its position in 35 males, will shew:—

TABLE I.

Shewing the level at which the right dome, the central leaflet, and the left dome of the diaphragm occurred in 35 male subjects.

	In right mammary line.	In middle line.	In left mammary line.
At the level of the 3rd rib or 3rd intercostal space	1 cases.	0 cases.	1 cases.
At 4th rib or space ...	13 ,,	2 ,,	7 ,,
At 5th rib or space ...	18 ,,	30 ,,	24 ,,
At 6th rib or space ...	3 ,,	3 ,,	3 ,,

Thus in 35 bodies the diaphragm varied, as to the level at which it occurs after death, to the extent of three intercostal spaces, or a distance of 3½ inches. The three cases in which it occurred at the level of the 6th space were examples of Glenard's disease.

An equal amount of variation was found in the 15 women, as is shewn in Table II.

TABLE II.

	In right mammary line.	In middle line.	In left mammary line.
At the level of the 3rd rib or 3rd intercostal space	0 cases.	0 cases.	0 cases.
At 4th rib or space ...	8 ,,	4 ,,	4 ,,
At 5th rib or space ...	6 ,,	9 ,,	10 ,,
At 6th rib or space ...	1 ,,	2 ,,	1 ,,

Two of the cases were examples of Glenard's disease.

The cause of the variability. After death, at any rate by the third day after death, the position assumed by the diaphragm is approximately that of complete expiration; the elasticity of the lungs draws the diaphragm up as far as it will yield. The low or high position of the diaphragm depends very little on the degree of distension of the abdomen or of the bowel.

Does a similiar variation occur in life? The answer is "yes." In three young men,

taken at random, and examined by the Röntgen rays, there was a variation of a space and a half in the level of the diaphragm. During the winter session I hope to extend my observations by this method over a wide series of both young and old, healthy and sick, for it is clearly evident that the Röntgen rays have put the living as well as the dead within the province of the anatomist, and it is the anatomy of the living subject only that is of real value to a medical student.

The Triple Action of the Diaphragm. How few medical men, as they watch the belly wall of a patient rise and fall with each breath, form an accurate mental picture of what is taking place within the abdomen. Their attention is chained to the thoracic walls. I found it was the description given of the diaphragm by text-books, which I have repeated to you year after year, that tripped up my imagination when it sought to realise what is occurring during an inspiration. You know what that description is. The muscle fibres of the diaphragm are described as rising from the circumference of the body cavity and concentrating to an insertion on the central tendon, like the spokes of a wheel to its nave. As long as you have that conception of the diaphragm you will never understand the movements of respiration. You must look on the diaphragm as a fan-shaped digastric muscle, with an origin from the spinal column by its stalk (the crural and arcuate fibres), while its spread-out radiating convex margin is inserted to the lower six ribs and costal cartilages. The central tendon corresponds to the intermediate tendon of such a muscle as the digastric or rectus abdominis. If the thoracic and abdominal cavities were empty, then the action of the diaphragm would be to pull the abdominal ends of the lower six ribs towards its origin from the lumbar region of the spine.

Its Action on the Abdomen. But the presence of the abdominal viscera prevents it from exerting such an action on the ribs, and that brings me to speak of the first movement of the diaphragm, or the first of the three burdens it has to undertake each time it contracts. The abdominal viscera project well within the thorax, carrying the diaphragm upwards over them like a hood (see Fig. I.) The first effort of the diaphragm, when it contracts, is spent on the abdominal viscera, pushing the contents of its domes, the liver, the stomach, the spleen and kidneys forwards and downwards against the muscular walls of the abdomen, the passive resistance of which it has to overcome. This abdominal load of the diaphragm has been much neglected in the estimation of the energy expended in a respiratory movement.

Its Action on the Thoracic Viscera. The diaphragm of man has not only a "push" load, represented by the abdominal viscera, but also a "pull" burden, represented by all the contents of the thoracic cavity. Not only does it cause the lungs to descend downwards and forwards by its contraction, but, by the attachment of the crural fibres to the inferior vena cava and pericardium, it draws the whole heart and roots of the lungs with it. I found the domes of the diaphragm descended over 3 inches, the central tendon over an inch, in men with an abdominal type of respiration, when they took a deep breath. The well-known curves of the œsophagus, which are found after death and during expiration, disappear during inspiration, the œsophagus, owing to the descent of the stomach, being stretched, and, at the same time, moves forwards from the spine for about one inch.

I have been in the habit of teaching that the central or mediastinal part of the diaphragm is practically fixed. I could not see what was to be gained by the descent and rotation of the heart on inspiration, and yet I could not account for the insertion of the strongest mass of the diaphragmatic muscles, namely the crural fibres, directly to the central, and, as commonly supposed, immovable part. But a study of the chest by the Röntgen rays made the matter plain. The heart in shape is a cone, apex above, base resting on the diaphragm below. The minute it descends it increases the pulmonary capacity of the chest; it is a conical plug, which when drawn down allows the lungs to expand inwards.

Action on the Ribs. But besides its abdominal and thoracic burdens, the diaphragm also exerts its power on its points of insertion, namely the abdominal ends of the six lower ribs. This I may call its costal burden, and this of the three directions in which it expands the force of each contraction is the most difficult to understand. How is it that the ends of those diaphragmatic ribs, when they are pulled on, do not move in towards the origin of the diaphragm from the lumbar region of the spine? The reason will be found in the relationship of the diaphragm to the abdominal viscera. The diaphragm from its fixed spinal origin passes vertically up behind the abdominal viscera, to the extent of 4 or 5 vertebræ, then it turns forwards over the liver, stomach and spleen, and then downwards in front of them. The action of the diaphragm on the ribs will wholly depend on the amount of resistance offered to the

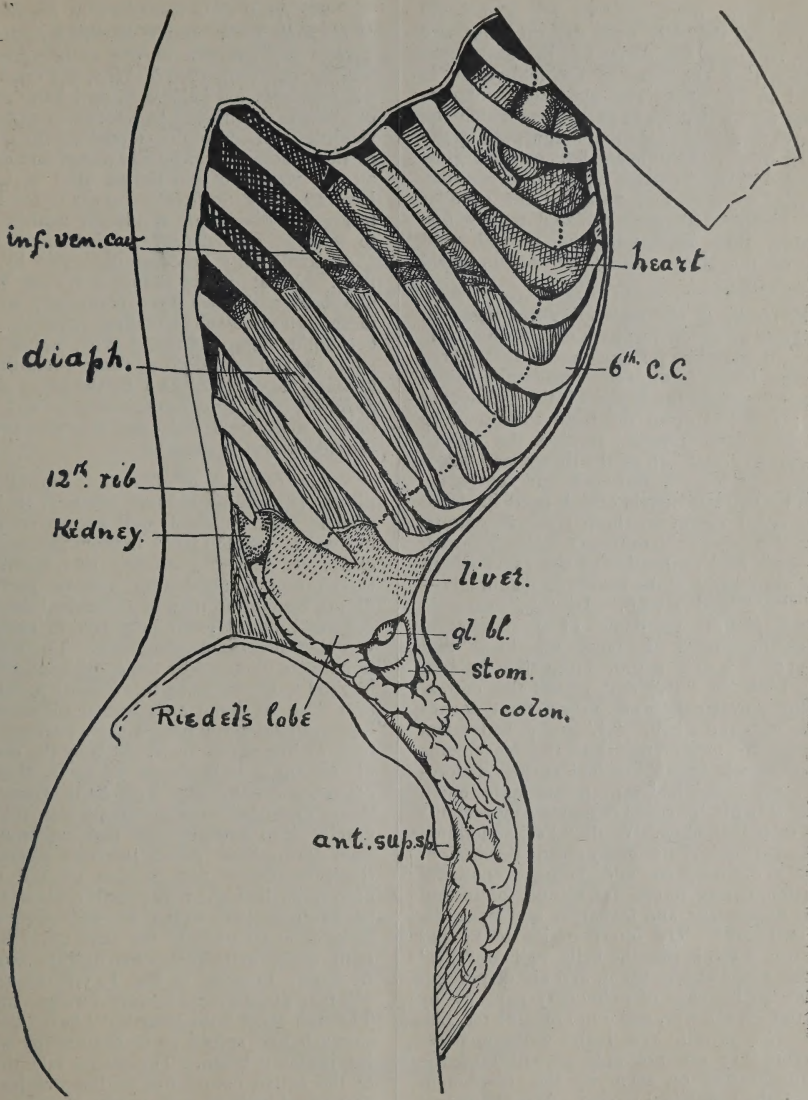

FIG. I.

Shewing the position of the viscera of the right side in a female body hardened in corsets. The direction of the fibres of the diaphragm is shewn, and it will be seen that they will tend to push the liver as much forwards as downwards.

descent of the diaphragm by the abdominal contents. If the belly walls are muscular and strong, and resist the descent of the abdominal contents, then the force of the diaphragm is exerted on the ribs. The abdominal contents become then a fulcrum or pulley over which the spread out insertion of the diaphragm pulls up the costal margin. The right and left costal margins, composed of the cartilages of the lower six ribs, are pulled upwards, and owing to the peculiar way in which the ribs are articulated to the spine, outwards, thus increasing the breadth and depth of the chest, and giving an increased lung capacity.

Variations in the mode of Breathing. In individuals in which respiration is normal, the diaphragm exerts its influence on all these three directions I have mentioned—on the abdominal viscera to increase the depth of the pulmonary space; it draws down the heart to allow the lungs to expand inwards; it raises the ribs to increase the costal wall of the thorax and allow the lung to expand forwards and outwards. But in no two individuals does it exert its force to an equal extent in these three directions. Three of us went to be examined by the Röngten rays—for a final verification of the exact extent of the movements of the heart and diaphragm—"J.," "R." and myself. In "J.," even in forced inspiration, the domes of his diaphragm scarcely descended an inch, his heart and central tendon only a little more than half an inch; while in "R." and myself the corresponding movements were nearly three inches and an inch and a half. "J." and I had taken very accurate measurements of the movements of our thoracic and abdominal cavities beforehand; my abdominal movements were much greater than his, his costal or thoracic movements much more than mine. While "J's." abdominal viscera were nearly stationary during respiration, "R's." and mine were undergoing a continual excursion, during forced respiration, of several inches downwards, and forwards, and upwards, and backwards. The interpretation to be put upon it is, I think, that the belly walls in "J's." case are active and resistant, and his diaphragm obtains an increase of pulmonary capacity by its action on the ribs, while in non-athletes, like "R." and myself, the belly walls are less resistant, they are not able to withstand the impetus exerted on them by the diaphragm through the abdominal viscera. We, abdominal breathers, have to move quietly along in life, sitting when we can, gaining our pulmonary space by the lazy and easy method of making our abdominal viscera play the part of a shuttlecock between the battledores of the diaphragm and muscular belly walls.

The result of a breakdown in the Resistance of the Belly Wall. But if anything happens to weaken the strength of our belly walls, what will be our case then? Why, our diaphragms will overcome our belly wall, and keep pushing our viscera downwards and forwards against our yielding recti and obliqui; pushing the contents of the abdomen ever further down, and drawing all the viscera of the thorax after it, until we have to apply artificial supports to our bodies, to give the diaphragm a fulcrum against which to work. The danger is increased if the abdominal cavity becomes distended by fat or fluid. What would happen if we became aldermen and grew very corpulent, with our mesenteries and sub-peritoneal tissue thick with two solid inches of fat? Why, nature would step in and develop a "fair rotundity" by undoing a stitch or two in the lower and less essential part, from a respiratory point of view, of our abdominal wall, and thus give room for the diaphragm to descend.

The Influence of Corsets. But Glenard's disease is many times more common in women than in men, and, as is well known, respiration in them is costal in type; in them the diaphragm exerts its influence on the ribs mostly, and therefore the abdominal viscera move less during respiration than in abdominal breathers. Figures I. and II. will help you to understand why they suffer more than men. These illustrations were obtained by the application of a new method to the study of this condition, for if you ever wish to make an advance in knowledge, however slight, you must make a new use of old tools or invent new ones. It is by the discovery of methods, rather than of facts, that great advances are made. The body from which these drawings were obtained was that of a middle aged woman, who had evidently worn stays during life. Before injecting formalin, for the preservation and fixation of the organs, corsets, such as she may possibly have worn in life, were applied, so that we were thus able to make an exact study of the anatomical relations of the abdominal viscera when tightly compressed by stays. Looking at Fig. I., you can see what will take place when a corsetted woman breathes. The tightened, hour-glass-waist keeps the liver, stomach and spleen from descending when an inspiration is taken. The corsets take the place of the active contraction of the muscles of the abdominal wall of a man who breathes mostly by the expansion of his ribs. The abdominal viscera yield only slightly, and hence the force of the diaphragm is spent on the ribs, which are raised upwards and outwards, and the woman, whether naturally a costal breather or not, becomes perforce a costal breather. She

cannot take a full meal, because there is not room left above her waist for the expansion of the stomach without encroaching on her respiratory space, unless she breathes the harder and raises her ribs the more. But what is happening to the muscles of the belly wall of a woman who laces over much? The corsets take their place—they are not required, and,

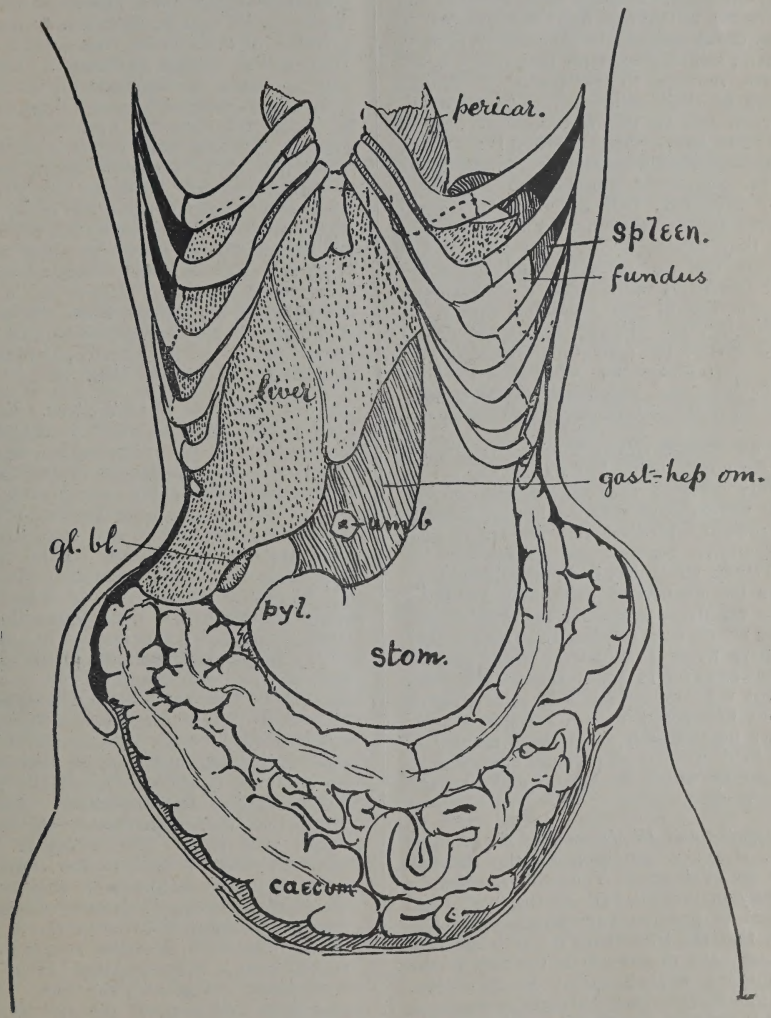

FIG. II.

The same subject as is shewn in Fig. I. viewed from the front.

when muscles are not required, they never care to play the part of unwelcome guests. If the individual of whom we write were always to remain young, her costal cartilages supple and unossified, and never to assume maternal duties, all would go well with her. But in most women at forty the costal cartilages begin to ossify and become stiff; at that age, most women begin to find they cannot execute the old costal respiratory movement, and so they undo their stays a bit, and have recourse to the partial abdominal breathing of their childhood. Or pregnancy may occur, and for this reason corsets have to be laid aside, and in what condition is a woman who has laced tightly under such circumstances? Why, her abdominal muscles are weak and partially atrophied; they cannot act as equal opponents to the diaphragm and expanding uterus, they cannot rally to the play of the diaphragm—but give before it, and hence the gradual descent of the abdominal viscera, and the production of the condition known as Glenard's disease. Hence its frequency in women. Hence the danger of Glenard's disease in women who resume work after confinement before their abdominal muscles have adapted themselves to the emptied abdomen.

In its essence *Glenard's disease is thus the result of a vitiated method of respiration;* it is a respiratory disease; the displacement of the thoracic viscera have escaped notice, but it is always present. Medical men are apt to scoff at comparative anatomy as an auxiliary of medical study, but if they had remembered that, with the introduction of pulmonary breathing into the vertebrate kingdom, the whole body wall has always been respiratory in nature, they would have never gone so far astray as they have done as to the nature of Glenard's disease. You must regard the belly wall, to as great an extent as the costal wall, as respiratory in function; unfortunately, in a good number of us, the belly wall, more than our chest wall, is the means by which we breathe and live and have our being.

Elongation and Displacement of the Stomach. Fig. II. shews a condition of the stomach familiar to clinicians. You will see that it lies mostly in the left half of the body, and is vertical in position and greatly elongated. Further, that the liver below the 10th and 11th ribs is prolonged downwards to the crest of the ilium, forming what is called Riedel's lobe. Notice, too, that the gastro-hepatic omentum is elongated, and that the lesser curvature of the stomach is not, as it should be, tucked under the margin of the liver. How does this condition come about? If you remember that the viscera, situated under the domes of the diaphragm, move downwards and forwards more than the parts under the heart, you will see that, with each breath, the liver and kidney on the right, and the stomach, spleen and kidney on the left, swing downwards, forwards and inwards with each inspiration. The anterior margin of the liver rides over the stomach, while the lesser curvature of the stomach passes under the liver. That is the normal movement. But if you apply pressure to the front of the abdomen, such as is applied by corsets, these organs can no longer ride forwards over each other, and give rise to the heaving forwards you see in the upper part of the abdomen during inspiration. Instead of moving forwards, they are pushed backwards by the corsets, and hence, as far as "any inspiratory" movement takes place in them, and the diaphragm pushes on them with each breath, the liver and the stomach move, and are elongated downwards. Hence the elongation of the gastro-hepatic omentum, the stretching of the vessels and structures which lie in it, the vertical position of the stomach, and the gradual production of a Riedel's lobe.

The Occurrence of Gall Stones. Every time I see a body opened, which is the subject of displacement of the viscera, I look for gall stones, and they are almost invariably present, or the biliary passages are greatly dilated, shewing that at one time they had been there. How is the presence of gall stones correlated with ptosis of the viscera? I do not for a minute say that this condition is the cause of gall stones; it is simply a condition which is highly favourable for their formation. How does it favour their formation? The explanation lies in a proper understanding of the manner in which the gall bladder and the bile passages are supported. The first point to remember is that the neck of the gall bladder, and the cystic and hepatic ducts, lie firmly imbedded in the gastro-hepatic omentum, and that, by that omentum, they are firmly fixed to the most stable and least yielding part of the diaphragm, namely, that part of the diaphragm which surrounds the inferior vena cava. The fundus of the gall bladder, however, is fixed to the under surface of the right lobe of the liver, that part of the liver which, in Glenard's disease, undergoes the greatest expansion downwards, for, in ptosis of the liver, the organ is always flattened out from back to front, and elongated in its vertical measurement. You will see that, while the cystic duct and neck of the gall bladder are fixed in position to the diaphragm, the fundus of the bladder is being pushed downwards, bringing a strain to bear on the cystic duct, and tending to occlude it. But another factor is

also at work. The cystic duct turns an angle of 40° to enter the common bile duct; here the spiral valve is developed to keep it open; but, as the liver is depressed, the angle at which the cystic duct enters the common bile duct becomes more acute, and the duct may be temporarily occluded. By either the one or the other factor, or both together, the lumen of the cystic duct becomes partially blocked, bile is locked up for passing periods in the gall bladder, and a condition favourable to the formation of gall stones is thus induced.

Diverticula of the Duodenum and Partial Hernia of the Stomach through the Diaphragm. Here I trench on what may be properly described as "corset disease," but since corsets are the prevailing cause of Glenard's disease, those conditions may be included here. In the case shewn in Figures I. and II., the duodenum, owing to the pressure at the waist, has been squeezed down until, instead of lying behind the liver and stomach, it comes to occupy a position on the brim of the pelvis. The pressure, we have seen, led to an elongation of the gastro-hepatic omentum, but it also led to an attempted elongation of the common bile duct, which, as has been already pointed out, is fixed at its upper end to the most stable part of the diaphragm. But the bile duct is coated with a layer of tough connective tissue; it will not yield, but the duodenal wall, which the duct perforates obliquely, is soft and extensible, and it yields. As the duodenum, as a whole, is pushed downwards, the part of its inner wall above the entrance of the bile duct is drawn up into a tent-shaped diverticulum. These diverticula are present in all women who have evidence in their bodies of tight corsets.

Last year Mr. Rigby showed a case at the Anatomical Society from a body in the Dissecting Room, of what appeared to be a dilatation of the œsophagus above the diaphragm. On looking round the Dissecting Room I found another case. I did not associate the condition with Glenard's disease at the time, because then I did not understand its true nature. But a microscopical examination showed that the dilatation was not of the œsophagus, or rather that in the dilatation, there was not only œsophagus, but also part of the stomach. From what I have said of the nature of Glenard's disease you will understand how such a condition is produced. As the belly walls yield in ptosis of the viscera, and the diaphragm descends, it comes to a point at which the œsophagus has reached its utmost stretch; its curves are undone and it cannot yield a half inch further. But the process of ptosis goes on and the diaphragm descends and part of the cardiac end of the stomach is pulled through between the œsophageal fibres of the diaphragm into the thorax and then comes to look like an œsophageal dilatation.

Floating Right Kidney. But how is it that the kidneys become displaced and why is it that the right kidney suffers ten times more frequently than the left? The anatomical relations of the two kidneys explain why the right is so frequently taken and the other left. If you look at the body (Fig. II.) you will see that the right kidney and liver form a solid mass, semi-fluid in life, filling the right dome of the diaphragm. For all present purposes the two organs may be regarded as one, so accurately are they moulded together. The movements of the deep or dorsal part of the liver correspond to those of the right kidney. But it is quite different with the left kidney. The diaphragm cannot get a firm grip of it, because the stomach and spleen form a movable intervening mass, varying in size and giving no firm purchase for the diaphragm to exert any influence.

As regards prolapse of the pelvic viscera and certain forms of hernia which form part of Glenard's disease I need not speak of now. The pelvic floor, formed by the levator ani, forms also part of the muscular abdominal wall and has to resist, in perhaps a less direct manner, but still resist and act as an opponent of the diaphragm.

Several reasons have induced to bring this subject up as my opening lecture; some of them respectable enough, some of them perhaps selfish. To tell the truth, I'm rather by nature a gossip, and if I have found anything that interests me, I cannot rest till I have got somebody to tell it to. But another reason is quite of good repute and is acknowledged by all the teachers of this College and Hospital, that it is our duty not only to teach you the best that is known, but to find out things so that we can teach you better than is generally known. The last of the three reasons given you for selecting this as the subject of my discourse is that it is generally held that anatomy is a subject now exhausted, antiquated, and largely useless. That I have tried to show it is not; anatomists are not so practical men as they might be, but with a change in the system of examination; with the free use of living subjects for the demonstration of surface anatomy, such as we now have, and with the installation of a Röngten ray apparatus, I feel confident that you will start your work in the wards, equal with, or better, as far as practical anatomy is concerned, than the students of any other College or University.